

HSI TF and ad hoc working group: Back and neck pain, vibration, and impact from military systems

USAARL Overview

John Crowley MD MPH
Science Program Director

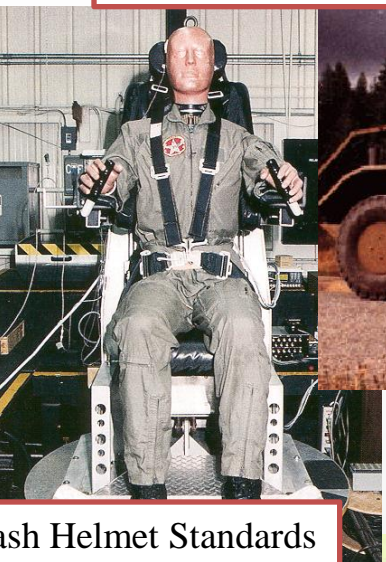
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UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY



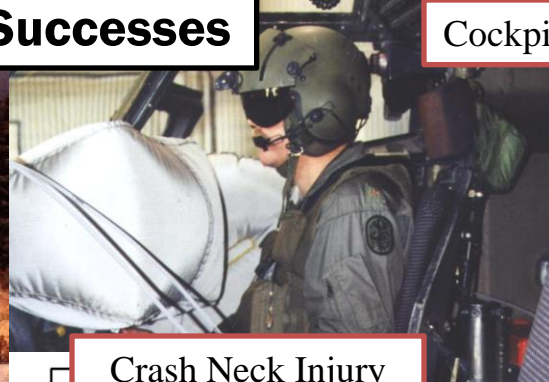
ISO Jolt Standard



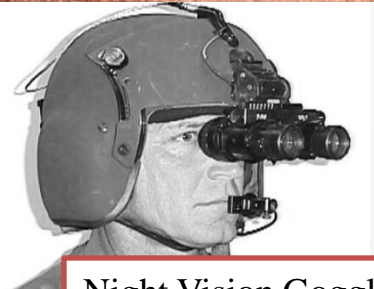
Historical Successes



Cockpit Air Bags

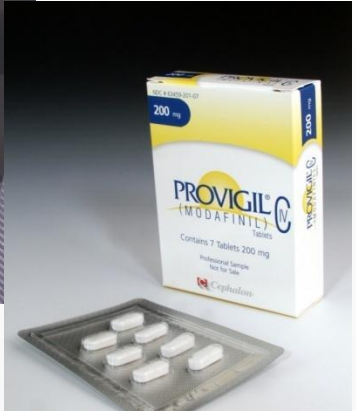


Crash Helmet Standards



Night Vision Goggles

Crash Neck Injury

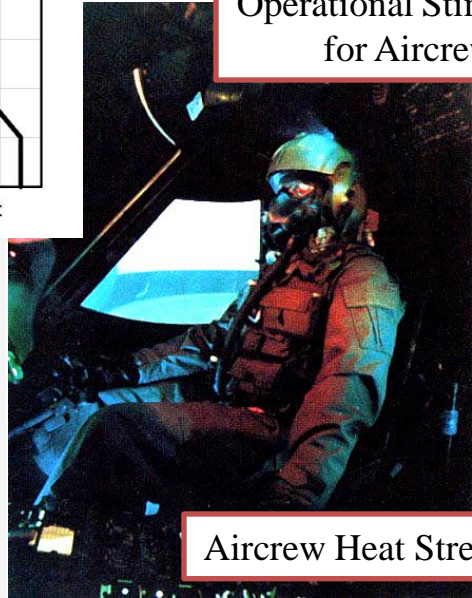


Operational Stimulants for Aircrew

Crash Survival



Aircrew Heat Stress



Jolt ISO Standard Summary

- A new biomedically-based method was developed for HHA of repeated shocks
- An International Standard (ISO 2631-5) was proposed and adopted in unusually fast time
- Both parts of the ISO 2631 and the HHA method have been implemented in a user-friendly software program used by CHPPM and supported by USAARL

WBV and Repeated Jolt Acceleration Data

UES, Inc.
Research, Development & Technology Transfer

Whole-Body Vibration & Multiple Shock

WBV
ISO 2631-1
Signal Processing & Health Hazard Assessment

JOLT
ISO 2631-5
Software Version 6.0
January 31 2006

This WBV-JOLT® software was developed jointly by UES, Inc. (under Army contract # DAMD17-03-D-0001) and the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

ISO

USACHPPM
Readiness thru Health

WBV and Repeated Jolt Acceleration Data - [Page 8: Risk Assessment Code]

File Name: VZAB1C05 Speed: 5 mph Terrain: paved Seat: Commander Vehicle/System: M1A1

Health risk assessment for the above conditions

Item		Fleet	
Severity Category	Probability Level	Severity Category	Probability Level
II	D	II	B
RAC = 3		RAC = 1	
III	D	III	B
RAC = 4		RAC = 3	

Repeated Jolt Hazard

Aquisition Program: Major ☒ Non-Major ☐ Risk Level: High

Decision Authority: AAE or designee

Risk Assessment Codes (Army Regulation 40-10)

	A	B	C	D	E
I	1	1	1	2	3
II	1	1	2	3	4
III	2	3	3	4	5
IV	3	5	5	5	5

Overall RAC

Recommended: 1 Re-assigned: 1

Delete Open Write Home Exit



U.S. Army Aeromedical Research Laboratory

Injury Biomechanics Branch

AIBS Review, 12-14 February, 2008





Medical Research and Materiel Command
U.S. Army Aeromedical Research Laboratory
Fort Rucker, Alabama



USAARL's Key Focus Areas Under MOM

Develop effective medical countermeasures against combat and operational stressors to maximize Warrior health, performance and fitness.

Science

INJURY

Injury Prevention and Reduction

THREATS

Blast Overpressure
Blunt Head and Body Trauma
Traumatic Brain Injury
Acoustic Trauma
Face, Eye and Spinal Cord Injury
Return to Duty for Wounded Soldiers

PSYCH

Psychological Health and Resilience

THREATS

Concussion (mTBI)
Return To Duty Standards for Wounded Soldiers

PHYSIO

Physiological Health

THREATS

ENVIRO

Environmental Health and Protection

THREATS

Soldier

Neck Pain in U.S. Army Female Aviators



John Crowley
Joanna Greig

US Army Aeromedical Research Lab

Vivienne Lee
QinetiQ Ltd, UK



Aircrew Protection Division



Conclusions

- 40% of US Army female aircrew (respondents) report in-flight neck pain.
- Neck pain during and after flight is associated with use of NVG's
- Neck pain during flight is associated with total hours of NVG use
- Neck pain during flight is associated with hours of NVG use per night



Aircrew Protection Division





Acute and Chronic Neck Injury Exercise Countermeasures Workshop



Friday, May 14, 2010
Sheraton Phoenix Downtown Hotel



Agenda at a Glance			
Time	Item	Speaker	Organization
Registration 0730-0800			
Administration			
0800-0810	Welcome, administrative announcements	John Crowley MD MPH Barry Shender PhD	US Army Aeromedical Research Laboratory US Naval Air Systems Command/TP-7 Chair
Overview			
0810-0840	Neck Pain, Injury, and Disease in Aviation	James Persson MD MPH LTC MC	US Army Aeromedical Activity
0840-0900	Current Treatment of CSD in Aircrew	Shean Phelps MD MPH LTC MC	US Army Aeromedical Research Laboratory
0900-0920	C-Spine Injury Modeling	Barry Shender PhD	US Naval Air Systems Command
Break 0920-0940			
Countermeasures			
0940-1000	Exercise as Injury Prevention	Ed Zambraski PhD	US Army Research Institute of Environmental Medicine
1000-1020	Muscle Training and Injury Studies	John Keel	Harvard University
1020-1040	Manipulation Therapy Studies	Jason Eggers DC	
1040-1100	Massage Therapy Studies	Jo Sefton PhD	Auburn University
Research Presentations			
1100-1130	C-Spine Assessment in Military Helicopter Crew	Maneke Van den Oord PhD	
1130-1200	Neck Exercise Training in Canadian Forces Helicopter Crew	Patrick Neary PhD	Regina University, Canada
Lunch 1200-1300			
Research Presentations (con't)			
1300-1340	Neck Problems in Swedish Air Force Helicopter Pilots	Bjorn Ang PhD	Karolinska ...
1340-1400	High Performance Fixed-Wing Neck Injury Countermeasures	Greg Hampson Nic Green	Royal Australian Air Force, Australia Royal Air Force, UK





Mitigation of acute and chronic neck pain in military aircrew



Problem

- Neck pain is a common complaint that can affect mission performance ranging from an incapacitating event to low level distraction

Purpose

- Evaluate a neck exercise program and manual manipulation therapy (MMT) as tools for the prevention of acute and chronic neck pain

Plan

- Recruit 80 subjects at Fort Rucker and Patuxent River
- Randomize into 4 groups (exercise, MMT, exercise and MMT, control) and follow their symptoms for 1 year.

Product/Payoff

- A tool for prevention of neck pain in aircrew

Progress

- Recruitment problems; scope extended and new push to recruit in Feb 2012
- Report completion est. 4Q/FY14

Schedule & Funding

MILESTONES	FY11	FY12	FY13	FY14
Literature Review	■			■ Planned Completion
Protocol Development	■			
Data Collection		■	■	■
Analysis/Writing			■	■
Total Funding =				





Mitigation of acute and chronic neck pain in military aircrew

- USN/USAARL collaboration
- Examines long term effectiveness of a graded core exercise program and/or manual manipulation therapy for prevention of neck pain and management of chronic neck pain. Based on original study by Dr Bjorn Ang.
- Approaching 1 year out of 3. Experiencing difficulties with recruitment.





Aircrew Health Cohort Study of Apache Mk1 Pilots



Schedule & Funding

MILESTONES	FY11	FY12
Literature Review	<div></div>	
Protocol Development	<div></div>	
Data Collection	<div></div>	
Analysis/Writing	<div></div>	<div></div>
Total Funding = \$		

Problem

- The Apache was newly introduced to the UK in 2000-2001
- Little was known about long term health effects of monocular helmet mounted displays

Purpose

- Analyze data collected form British Army pilots over a 10 year period
- Compare visual, neck and back symptoms of Apache aircrew with non-Apache aircrew

Plan

- Collate data then analyze questionnaires and examinations for statistical differences

Product/Payoff

- Increased knowledge of risks to Apache aviators

Progress

- Database created, initial descriptive statistics and entry level statistics complete. Longitudinal analysis ongoing.
- Report completion est. 4Q/FY12





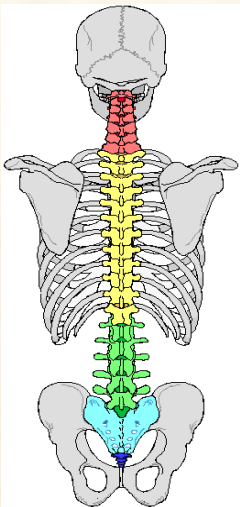
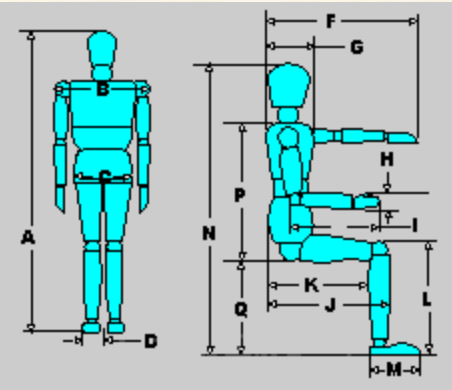
Aircrew Health Cohort Study of Apache Mk1 Pilots

- Study predominantly aimed at visual effects of IHADSS however questionnaire included neck and back symptoms.
- Currently analyzing data however small numbers of Apache aircrew and high dropout rate reduce likelihood of significance in data.





Anthropometry neck and back pain study



Problem

- Anthropometry recommendations are often ignored when selecting aircrew
- Neck and back pain are common disabling or incapacitating conditions among aircrew

Purpose

- Determine whether there is evidence that extreme anthropometric measurements are a risk factor for neck and back pain among aircrew

Plan

- Measure and survey aircrew volunteers (front and rear, all airframes) based at Fort Rucker

Product/Payoff

- Model for measurements that best predict neck or back pain in aircrew

Progress

- Data collected from 88 aircrew (3 female)
- Data analysis in progress
- Report completion est.4Q/FY12

Schedule & Funding

MILESTONES	FY10	FY11	FY12
Literature Review			Planned Completion
Protocol Development			
Data Collection			
Analysis/Writing			
Total Funding = \$1.25M	200K	451K	354K





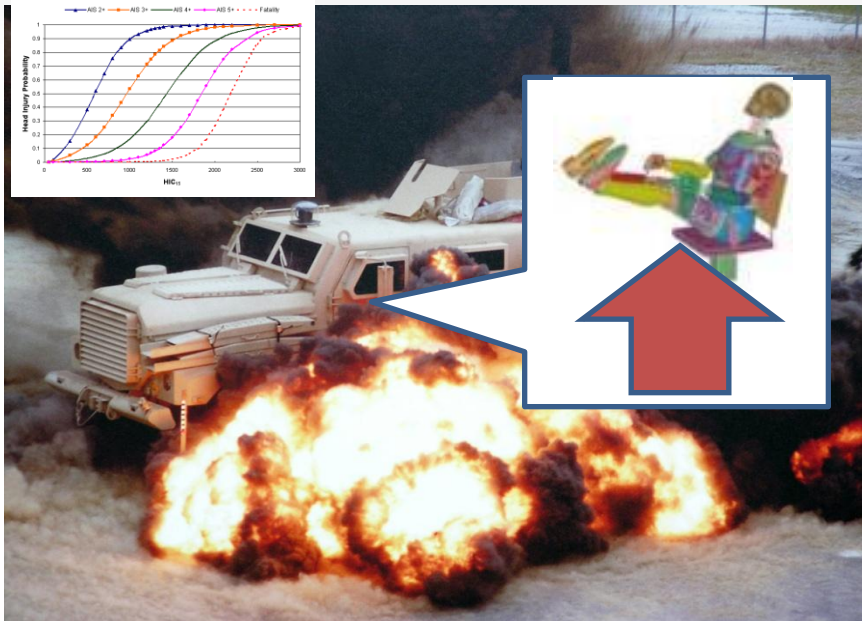
Anthropometry neck and back pain study

- Study to evaluate anthropometric measures as risk factors for neck and back pain
- Data collected from 88 aircrew (front and rear), currently being analyzed.





WIAMan Program FY11-17



Schedule & Funding

MILESTONES	FY11	FY12	FY13	FY14	FY15	FY16	FY17
Define Warrior Environment							
Cadaveric Testing							
Injury Assessment Dev.							
Guidance to Stakeholders							
WIAMan Gen 1 Fab, & Test							
WIAMan Gen 2 Fab, & Test							

FY17 funds to be obtained through a coordinated 14 POM request



DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE

Purpose:

Conduct cadaveric research to establish a scientific and statistical basis for evaluating **SKELETAL** injuries to occupants during Under Body Blast events.

Develop an improved blast test manikin that incorporates the medical research which provides an increased capability to measure and predict skeletal occupant injury during Under Body Blast events.

Results:

- A medically validated set of skeletal injury criteria for occupant injury during blast events
- Human response curves that inform the concurrent design and Biofidelity of the blast test manikin
- Improved prototype blast test manikin that incorporates the medical research which provides an increased capability to measure and predict occupant injury during Under Body Blast events

Payoff:

- Improved ability to accurately measure the occupant injury from accelerative loads during Under Body Blast Testing by using medically validated accelerative loading methodologies and metrics
- Increased knowledge of soldier survivability in Under Body Blast Testing
- Potential for enhanced vehicle design and soldier survivability

POINT of CONTACT

Dr. John S. Crowley
334-255-6917
DSN 558-6917
john.s.crowley@us.army.mil



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